

FOSSIL VERTEBRATES FROM NEW EXPOSURES OF THE WESTBURY FORMATION (UPPER TRIASSIC) AT NEWARK, NOTTINGHAMSHIRE

by

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Summary

A sequence of shales containing bone-bearing sands and silts in the Westbury Formation (upper Triassic) is described from new exposures to the south of Newark-upon-Trent, Nottinghamshire. A rich vertebrate fauna is shown to contain fragmentary remains of dinosaurs, terrestrial reptiles of uncertain affinities, marine reptiles, and abundant fishes.

Introduction

The uppermost Triassic of south-east Nottinghamshire is represented by a series of black shales and thin muddy limestones, the Penarth Group. These beds, formerly called the Rhaetic beds, lie non-sequentially over grey-green mudstones, the Blue Anchor Formation, of the Mercia Mudstones Group.

The Penarth Group can usually be divided into two distinct units, a lower Westbury Formation and an upper Lilstock Formation. Only the Westbury Formation is seen at Newark.

The Westbury Formation in Nottinghamshire is largely argillaceous with a few thin sandy limestones. A complex of thin bone-bearing silts and conglomerates occurs towards the base (the Rhaetic bone-beds of previous authors: Sykes, 1974, Antia, 1979; Duffin, 1979). Other parts of the succession are poorly fossiliferous and have yielded a restricted bivalve fauna, often consisting of one or two species only, and usually confined to a few bedding planes.

Upper Triassic sediments are infrequently exposed in the English Midlands (Kent, 1968), and very little of Rhaetic sediments has been seen in recent times. For this reason the exposures at Newark are important in providing new information on the palaeontology and stratigraphy of the Penarth Group.

The two pits worked at present are being back-filled as work progresses and the exposures will only be accessible for a limited time. These notes, therefore, are intended to record the stratigraphy and palaeontology of the exposures whilst they are visible.

All figured specimens have been deposited in the Department of Geology, Leicester University collection, and are prefixed LEIUG.

Locality

Two pits in the Newark district now display sections through the Westbury Formation, where recent advancement of opencast workings for the extraction of gypsum has revealed several new exposures:

Bantycok Pit—National Grid Ref. SK 811502

Staple Pit —National Grid Ref. SK 805499

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Both pits are owned by British Gypsum. Permission to enter the pits can be obtained by writing to their office at Beacon Hill, Newark. (See Fig. 1).

The exposures at both pits display red gypsum-bearing mudstones of Trent Formation and grey-green mudstones of the Blue Anchor Formation, all within the Mercia Mudstones Group. At the eastern end of both pits up to five metres of black shales of the Westbury Formation are exposed. A measured section through the black shales at the Staple Pit is shown in Fig. 2.

Sedimentology

The Westbury Formation at Staple Pit is dominated by black shales with occasional thin sandstones, and rare lenticular limestones. Towards the base of the formation a silty horizon (beds 4–6, fig. 2) is developed which yields abundant vertebrate remains. In some places these are so rich in vertebrates that they constitute a bone bed. Up to 26 cm. of bone-bearing sediments occur within a 4.6 m. section of the black shales.

The shales are dark grey-black, often laminated, and are fissile when weathered. The laminae are thin silty layers, often rich in muscovite mica. The shales contain an impoverished bivalve fauna consisting of *Modiolus hillanus* (J. Sowerby), and an unidentified heterodont bivalve, (see Sykes et. al. 1970, pl. 18. fig. 13) A fragment of a strongly ribbed bivalve may be attributable to *Rhaetavicula contorta* (Portlock). Some bedding planes are crowded with bivalves, convex upwards, suggesting the presence of currents, but there is no preferred orientation, and the presence of lamination suggests the currents were gentle. Occasional vertebrate remains—fish teeth and scales, are also encountered in the shales.

The bone-bearing part of the section has a complex sedimentological history. The first occurrence of the bone bed is marked by a sharp break, with a thin conglomerate (0–3cm) containing phosphatised coprolites up to 12 cm long. White and pink quartz pebbles are also abundant. The whole is enclosed in a sandy matrix, portions of which are cemented by pyrite. In some areas this bed contains large quantities of fish teeth and scales, but the beds pass laterally into fine sands devoid of bones, teeth and coprolites. This might suggest that the heavier bone material is concentrated in very shallow depressions on the sea floor that are now imperceptible to the observer. Small authigenic bipyramidal quartz crystals have been reported from the Rhaetic Bone Beds (Antia and Sykes, 1979), and have also been found at this horizon.

Above the coprolite-rich conglomerate is a thin (1 cm.) layer of fine micro-cross laminated sands, with a smoothly undulating upper surface; probably ripple marks, but no large surfaces could be seen to confirm this. This bed also contains small fish-teeth and scales, but no larger fragments. A single oyster encrusting the surface of this bed suggests it may have been a hard ground.

The beds above this layer vary in character. In some places they are a dark grey blocky clay, in others a heavily bioturbated dark grey silt with many burrows preserved in a light grey micaceous silt. This silt horizon is up to 10 cm. thick and passes upward into black, laminated shales or in one place into 13 cm. of dark grey silty clay with a hackley fracture. This bed contains an abundance of small fish teeth and scales. Detailed collecting has been undertaken from the bone-bearing horizons and a diverse fish and reptile fauna is indicated.

There is a considerable lateral variation in the thickness of the bone beds. Along a fifty metre pit face they pass from some 26 cm. of richly fossiliferous sands and clays to no more than 3 cm. of sparsely fossiliferous fine sand.

Sampling methods

Approximately a half tonne of bone bearing material was removed by a party of five members of the Leicester Literary and Philosophical Society, Geology section. Some hand picking of fossils was undertaken at the site (mainly Staple Pit) for larger vertebrate material, mainly vertebrae and large teeth. The remainder of the material was broken down in quantities of approximately 1 kg. by soaking in 50% hydrogen peroxide. The material was then passed through 2.0 mm, 800 μm , 500 μm , and 250 μm , mesh sieves. This process removes most of the clay fraction, leaving a residue of quartz grit, coprolites, bones, teeth, and fish scales. The coarser fractions are then picked using a low power binocular microscope. The fine fractions were further concentrated by separating in 1.1.2.2. tetrabromoethane in a fume cupboard.

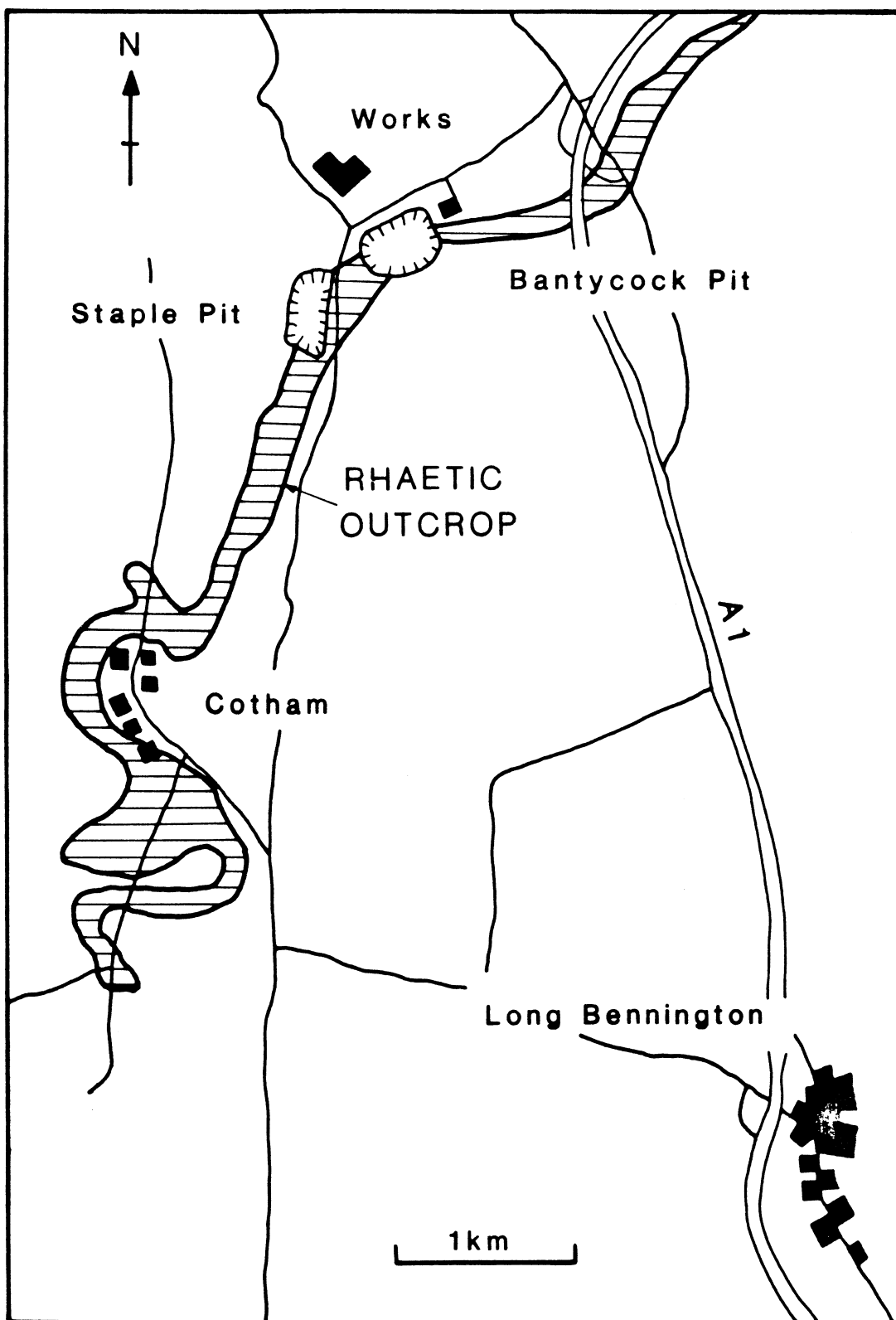


Fig. 1. Map showing the location of the two gypsum pits with new exposures of the Westbury Formation.

Vertebrate fauna

Vertebrate fossils from the bone beds vary from exceptionally well-preserved skeletal elements to unidentifiable worn fragments of bone and teeth. It is possible that fossils from several different populations are represented, with continual reworking and mixing of faunal elements. Fish remains are most prominent in the fauna, with elasmobranchs, palaeoniscids and holosteans represented by abundant teeth and occasionally jaw fragments. Reptile remains are fairly common, plesiosaurs and ichthyosaurs being most frequent, but terrestrial reptiles are also recorded—*Rysosteus oweni* of uncertain relationship is probably an amphibious reptile.

The terrestrial fauna is sparse, and indicated by fragmentary remains only. These include teeth, and a claw of a prosauropod dinosaur. Comparison of the claw with material in the University Museum Tübingen, West Germany suggests that it is allied to the genus *Plateosaurus*, and is most comparable to the claw on the fourth digit of the pes (Weishampel D.B. pers. comm.).

Vertebrate faunal list

Pisces

Acrodus minimus Agassiz.
Hybodus minor Agassiz.
Hybodus cloacinus Quenstedt.
Nemacanthus monolifer Agassiz.
Pseudodalatius barnstonensis (Sykes).
Birgeria acuminata (Agassiz).
Gyrolepis alberti Agassiz.
Saurichthys longidens Agassiz.
Sargodon tomicus (Plieninger).
Lepidotes barnstonensis Sykes.
Lepidotes sp.

Reptilia

Ichthyopterygia Isolated teeth, jaw fragments and vertebrae (pl. 8, fig. F).
Sauroptrygia Isolated teeth, vertebrae and phalangeal elements (pl. 8, fig. A).
Crocodilia A single worn tooth (pl. 8, fig. D).
Dinsoauria *Plateosaurus* sp. an isolated claw (pl. 8, fig. E) and a single tooth.
Incertae sedis *Rysosteus oweni* Owen, Isolated vertebrae (pl. 8, fig. G) and neural arches. The proximal end of a humerus (pl. 8, fig. B) may also be attributable to this taxon.

Discussion

The bone-beds of the Westbury Formation have been of considerable importance in Triassic vertebrate palaeontology, and have played an important role in the discussion of bone-bed formation and diagenesis. (Antia 1979).

A number of workers have examined Rhaetian bone-beds in the East Midlands at several localities, (see text figure 3) especially between Glen Parva, Leicestershire and Newark, Nottinghamshire. (Browne 1889, 1894, Fox-Strangeways 1903, Horwood 1916).

Many of the localities examined by these early workers have now disappeared, and for this reason it was felt that this new locality should be placed on record. New localities appear very infrequently, only the railway cutting at Barnstone having been described in recent times. (Sykes 1971, 1974, 1979, and Sykes, et. al. 1970).

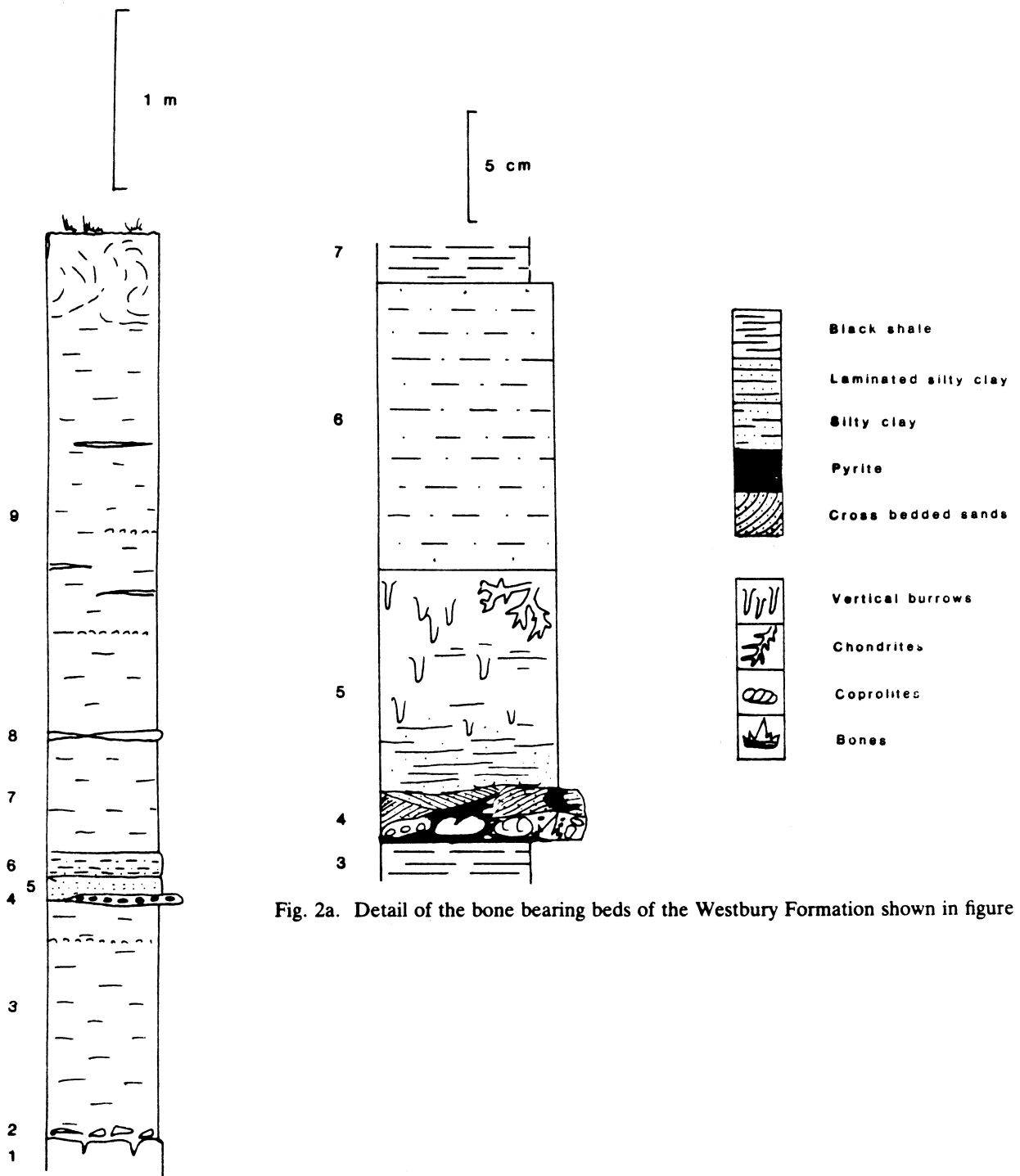


Fig. 2a. Detail of the bone bearing beds of the Westbury Formation shown in figure 2.

Fig. 2. Section through the Westbury Formation at Staple Pit, Near Newark, Nottinghamshire.

Kent (1970) does not record ossiferous deposits from the Rhaetian at Newark, but Johnson (1950) mentions a fish and reptile fauna from shales in a road cutting at Beacon Hill, Newark, National Grid Reference SK 810530.

The Staple Pit exposure is therefore all the more important in having provided a rich and diverse vertebrate fauna in an area where very little material has been found previously, and in yielding the only plateosaurid dinosaur remains from the East Midlands.

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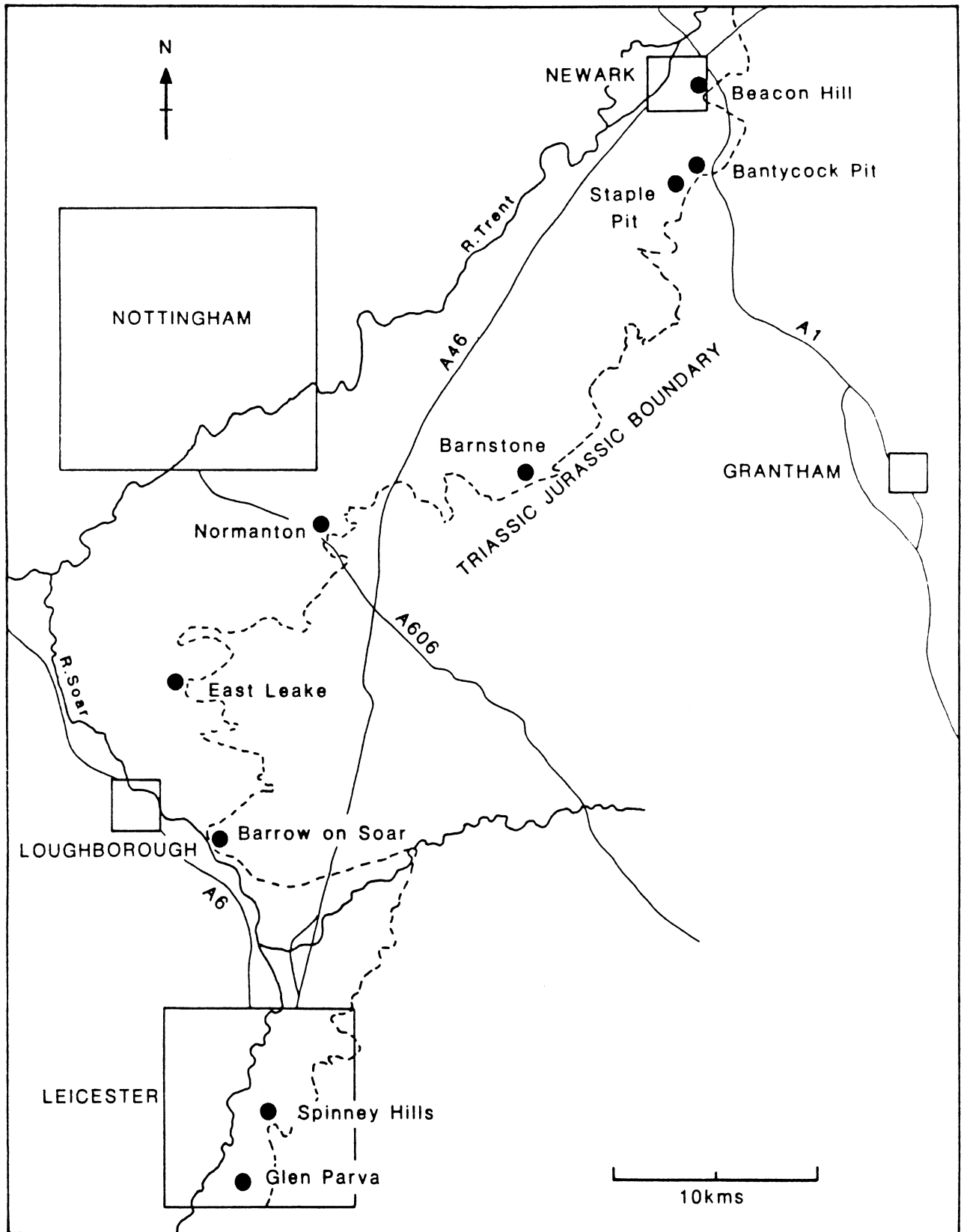


Fig. 3. Map showing the location of the main vertebrate bearing localities of the Westbury Formation in the East Midlands.

Explanation of Plate 8

Reptilian remains from the Westbury Formation at Staple Pit, Newark, Nottinghamshire. A Plesiosaurian phalanx, LEIUG 88986, x2. B. *?Rysosteus oweni* Owen, proximal end of humerus, LEIUG 88988, x1.5. C. *?Rysosteus oweni*, Ilium, LEIUG 88989, x1.5. D. Crocodilian tooth, LEIUG 88985, x3. E. *Plateosaurus* sp. Claw from ?IV digit of pes, LEIUG 88984, x2. F. Worn ichthyosaur vertebrae, LEIUG 88987, x2. G. *Rysosteus oweni*, ?sacral vertebra, ventral view, LEIUG 88990, x3.

